Claims

1. A method of treating a gaseous medium including nitrogenous oxides to remove the nitrogenous oxides therefrom, characterised in that there is included the operations of oxidatively activating a gaseous hydrocarbon by generating an electric discharge in the gaseous hydrocarbon in the presence of a gas permeable first material adapted to have oxidative properties in the presence of a non-thermal plasma and contacting a combination of the activated hydrocarbon and gaseous medium with a second material adapted in the presence of the activated hydrocarbon to catalyst the reduction of the nitrogenous oxides in the gaseous medium to nitrogen.

2. A method according to claim 1 characterised in that the gaseous medium includes carbonaceous particulate material and the gaseous medium also is subjected to oxidation by the first material.

3. A method according to claim 1 or claim 2 characterised in that the hydrocarbon is added to the gaseous medium.

4. A method according to any preceding claim characterised in that the first and second materials are particulate and are intimately mixed and that the volume ratios of the first and second materials lie in the range twenty to eighty per cent.

5. A method according to any of claims 1 to 4 characterised in that the first and second materials are confined to separate regions of a reactor system and that the gaseous medium and hydrocarbon are passed through the region containing the first material before the region containing the second material.

6. A method according to any preceding claim characterised in that the first material is barium or calcium titanate.

7. A method according to any preceding claim characterised in that the second material is selected from the group comprising the aluminas known as Alcoa LD-350, Catal Industrial CT-530, Condea hollow extrudates, T-60 Alumina, and Cordierite, or mixtures thereof.

8. A method according to any preceding claim characterised in that the second material is photo catalytic.

9. A method according to claim 8 characterised in that the second material is titanium dioxide or cerium dioxide.

10. A method according to claim 9 characterised in that the second material is a mixture of the anatase and textured rutile phases of titania.

11. A method according to any of claims 1 to 6 characterised in that the second material is a mixture of equal parts by weight of anatase phase titania and zirconia.

12. A method according to any of claims 1 to 6 characterised in that the second material is a metal-doped zeolite containing a material adapted to produce catalysis promoting cations.

13. A method according to claim 12 characterised in that the zeolite second material contains cerium or lanthanum.

14. A method according to any preceding claim characterised in that the gaseous medium is the exhaust emissions from an internal combustion engine.

15. A method according to claim 14 characterised in that the hydrocarbon is provided by unburnt hydrocarbons present in the exhaust emissions.

16. A reactor system for the plasma assisted treatment of a gaseous medium to remove nitrogenous oxides therefrom characterised in that there is included a gas permeable body (411) including a first material (412) adapted in the presence of a non-thermal plasma to activate oxidatively a gaseous hydrocarbon passing therethrough, a gas permeable body including a second material (412) adapted in the presence of an oxidatively activated hydrocarbon to catalyse the reduction to nitrogen of nitrogenous oxides contained in the gaseous medium and means for applying to the first material a potential sufficient to excite an electric discharge in a gaseous hydrocarbon passing through the body (411) of the first material.

17. A reactor system according to claim 16 characterised in that the first and second materials are particulate in form and are mixed together.

18. A reactor system according to claim 17 characterised in that the ratio of the surface areas of the particles (412) of the first and second materials lies in the range twenty to eighty per cent.

19. A reactor system according to claim 16 characterised in that the body (806) of the first material is separate from the body (805) of the second material and upstream thereof, and a combination of the gaseous medium from

which nitrogenous oxides are to be removed and a hydrocarbon are passed through the body (806) of the first material before being passed through the body (805) of the second material.

20. A reactor system according to claim 16 characterised in that there is provided a source (801) of a gaseous hydrocarbon, a reactor (802) to which the source of hydrocarbon (801) is connected, the reactor (802) containing a gas permeable bed of the first material and means for establishing an electric discharge in the gaseous hydrocarbon in the interstices in the bed of the first material, a second reactor (805) including a gas permeable bed of the second material and means (803) for combining plasma activated hydrocarbon from the reactor (802) with the gaseous medium from which nitrogenous oxides are to be removed prior to the combination passing into the reactor 805.

21. A reactor system according to claim 20 characterised in that there is included a reactor (807) through which the gaseous medium from which nitrogenous oxides are to be removed are passed prior to the combination of the plasma activated hydrocarbons therewith, the reactor (807) also including a gas permeable bed of the first material and means for establishing an electrical discharge in the gaseous medium in the interstices of the bed of first material in the reactor (807) thereby to effect the oxidation of particulate carbonaceous material in the gaseous medium.

22. A reactor system according to any of claims 16 to 21 characterised in that there is included means for establishing an electrical discharge in the gaseous medium within the interstices of the gas permeable body of the second material.

23. A reactor system according to any of claims 16 to 22 characterised in that the first material is barium titanate or calcium titanate.

24. A reactor system according to any of claims 16 to 23 characterised in that the second material is selected from the group comprising the aluminas known as Alco LD-350, Catal Industries CT-530, Condea hollow extrudates and Cordierite or mixtures thereof, metal doped zeolites further containing a material adapted to produce catalysis producing cations, mixtures of anatase and rutile phase titanias and photocatalytic metal oxides.

25. A reactor system according to claim 24 characterised in that the second material is a metal-doped zeolite also containing cerium of lanthanum.

26. A reactor system according to claim 24 characterised in that the second material is titanium dioxide or cerium dioxide.

27. A reactor system according to any of claims 16 to 23 characterised in that the second material is a mixture of equal parts by volume of anatase phase titania and zirconia.